

LONG-FINNED PILOT WHALE (*Globicephala melas*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of pilot whales in the Western Atlantic — the Atlantic or long-finned pilot whale, *Globicephala melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to identify to the species level at sea; therefore, some of the descriptive material below refers to *Globicephala* sp., and is identified as such. The species boundary is considered to be in the New Jersey to Cape Hatteras area. Sightings north of this area are likely *G. melas*.

Pilot whales (*Globicephala* sp.) are distributed principally along the continental shelf edge in the winter and early spring off the northeast USA coast, (CETAP 1982; Payne and Heinemann 1993). In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters, and remain in these areas through late autumn (CETAP 1982; Payne and Heinemann 1993). In general, pilot whales generally occupy areas of high relief or submerged banks. They are also associated with the Gulf Stream north wall and thermal fronts along the continental shelf edge (Waring *et al.* 1992; NMFS unpublished data).

The long-finned pilot whale is distributed from North Carolina to Iceland and possibly the Baltic Sea (Sergeant 1962; Leatherwood *et al.* 1976; Abend 1993). The stock structure of the North Atlantic population is currently unknown (Anon. 1993a); however, several recently initiated genetic studies and proposed North Atlantic sighting surveys will likely provide information required to delineate stock boundaries.

POPULATION SIZE

The total number of long-finned pilot whales off the eastern USA and Canadian Atlantic coast is unknown, however, eight estimates are available (Table 1, Figure 1): although ten estimates from selected regions of the habitat do exist for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas (Figure 1). Two estimates were derived from catch data and population models that estimated the abundance of the entire stock. Six ~~Seven~~ seasonal estimates are available from selected regions in USA waters during spring, summer and autumn 1978-82, August 1990, June-July 1991, August-September 1991, June-July 1993, and July-September 1995, and July-August 1998. Because long-finned and short-finned pilot whales are difficult to identify at sea, seasonal abundance estimates were reported for *Globicephala* sp., both long-finned and short-finned pilot whales. One estimate is available from the Gulf of St. Lawrence.

Mitchell (1974) used cumulative catch data from the 1951-61 drive fishery off Newfoundland to estimate the initial population size (ca. 50,000 animals).

Mercer (1975), used population models to estimate a population in the same region of between 43,000-96,000 long-finned pilot whales, with a range of 50,000-60,000 being considered the best estimate.

~~A population size of 11,120 (CV=0.29) *Globicephala* sp. was estimated from an aerial survey~~

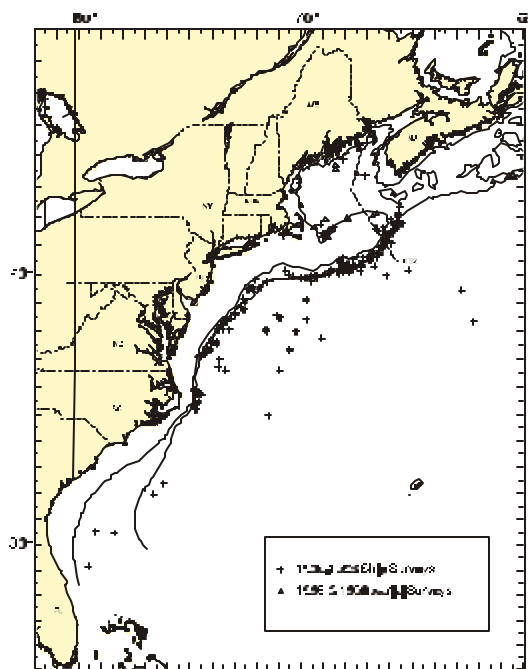


Figure 1. Distribution of pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1990-1998. Isobaths are at 100 m and 1,000 m.

program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (Table 1; CETAP 1982). The estimate is based on an inverse variance weighted pooling of spring, summer and autumn data. An average of these seasons were chosen because the greatest proportion of the population off the northeast USA coast appeared in the study area during these seasons. This estimate does not include a correction for dive-time or $g(0)$, the probability of detecting an animal group on the track line. This estimate may not reflect the current true population size because of its high degree of uncertainty, its old age, and it was estimated just after cessation of extensive foreign fishing operations in the region.

——— A population size of 1,043 (CV=0.78) *Globicephala* sp. was estimated from an August 1990 shipboard line transect sighting survey, conducted principally along the Gulf Stream north wall between Cape Hatteras and Georges Bank (Table 1; Waring *et al.* 1992). Data were collected by one team that searched by naked eye and analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school size-bias, if applicable, but do not include corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

——— A population size of 3,636 (CV=0.36) *Globicephala* sp. was estimated from a June and July 1991 shipboard line transect sighting survey conducted primarily between the 200 and 2,000m isobaths from Cape Hatteras to Georges Bank (Table 1; Waring *et al.* 1992; Waring 1998). Data were collected by one team that searched by naked eye and analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school size-bias, if applicable, but no corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

——— A population size of 3,668 (CV=0.28) and 5,377 (CV=0.53) *Globicephala* sp. was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (Table 1; Anon. 1991). The study area included that covered in the CETAP study plus several additional continental slope survey blocks. Due to weather and logistical constraints, several survey blocks south and east of Georges Bank were not surveyed. The data were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993), where the CV was estimated using the bootstrap option. The abundance estimates do not include $g(0)$ and were not pooled over platforms because the inter-platform calibration analysis has not been conducted.

An abundance of 11,120 (CV=0.29) *Globicephala* sp. was estimated from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance of 3,636 (CV=0.36) *Globicephala* sp. was estimated from a June and July 1991 shipboard line transect sighting survey conducted primarily between the 200 and 2,000m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998). An abundance of 3,668 (CV=0.28) and 5,377 (CV=0.53) *Globicephala* sp. was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (Anon. 1991). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

~~A population size~~ An abundance of 668 (CV=0.55) *Globicephala* sp. was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (Table 1; Anon. 1993b). Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

An abundance population size of 8,176 (CV=0.65) *Globicephala* sp. was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; NMFS/NEFSC unpublished data). Total track line length was 32,600 km (~~17,600 nmi~~). The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996). —This survey included the same region as that covered during the above 1991 and 1992 sighting surveys. Shipboard data were collected using a two independent sighting team procedure and were analyzed using the product integral method (Palka 1995) and DISTANCE (Buckland *et al.* 1993). Shipboard estimates were corrected for $g(0)$ and, if applicable, also for school size-bias. Standard aerial sighting procedures with two bubble windows and a belly window observer were used during the aerial survey (Palka 1996). An estimate of $g(0)$ was not made for the aerial portion of the survey. Estimates

do not include corrections for dive-time or platform avoidance. Variability was estimated using bootstrap re-sampling techniques.

Kingsley and Reeves (1998), obtained an abundance estimate of 1,600 long-finned pilot whales (CV=0.65) from a late August and early September 1995 aerial survey of cetaceans in the Gulf of St. Lawrence in 1995 and 1998 (Table 1). Based on an examination of long-finned pilot whale summer distribution patterns, and information on stock structure it was deemed appropriate to combine these estimates with NMFS 1995 summer survey data. The best 1995 abundance estimate for *Globicephala* sp. is the sum of the estimates from the USA and Canadian surveys, 9,776 (CV=0.55), where the estimate from the USA survey is 8,176 (CV=0.65) and from the Canadian 1,600 (CV=0.65).

An abundance of 6,208 (CV=0.44) for *Globicephala* sp. was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38°E N) (Figure 1; Palka, Waring and Potter In review). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 4,724 (CV=0.61) for *Globicephala* sp. was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38°E N) (Figure 1; Mullin In review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for *Globicephala* sp. is the sum of the estimates from the two 1998 USA Atlantic surveys, 10,932 (CV=0.36), where the estimate from the northern USA Atlantic is 6,208 (CV=0.44) and from the southern USA Atlantic is 4,724 (CV=0.61). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Although the 1990-1995-1998 surveys did not sample the same areas or encompass the entire pilot whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern USA coast. The collective 1990-95-98 data suggest that, seasonally, at least several thousand pilot whales are occupying these waters; however, survey coverage to date is not judged adequate to provide a definitive estimate of pilot whale abundance in the western North Atlantic.

————— The best available current abundance estimate for *Globicephala* sp. is 8,176 (CV=0.65) as estimated from the July to September 1995 line transect survey (NMFS unpublished data.) because this survey is recent and provided the most complete coverage of the known habitat.

Table 1. Summary of abundance estimates for the western North Atlantic *Globicephala* sp. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

| Month/Year | Area | N_{best} | CV |
|------------------------------------|--|------------------|----------------|
| 1951-1961 | Newfoundland | 50,000 | None reported |
| 1951-1961 | Newfoundland | 50,000-60,000 | None reported |
| spring, summer & autumn 1978-82 | Cape Hatteras, NC to Nova Scotia | 11,120 | 0.29 |
| Aug 1990 | Gulf Stream | 1,043 | 0.78 |
| Jun-Jul 1991 | Cape Hatteras, NC to Georges Bank, shelf edge only | 3,636 | 0.36 |
| Aug-Sep 1991 | Cape Hatteras, NC to Nova Scotia | 3,668 and 5,377* | 0.28 and 0.53* |
| Jun-Jul 1993 | Georges Bank to Scotian shelf, shelf edge only | 668 | 0.55 |
| Jul-Sep 1995 | Virginia to Gulf of St. Lawrence | 8,176 | 0.65 |
| Aug-Sep 1995 | Gulf of St. Lawrence | 1,600 | 0.65 |
| Jul-Sep 1995 | Virginia to Gulf of St. Lawrence | 9,776 | 0.55 |
| Jul-Sep 1998 | Maryland to Gulf of St. Lawrence | 6,208 | 0.44 |
| Jul-Aug 1998 | Florida to Maryland | 4,724 | 0.61 |
| Jul-Sep 1998 | Florida to Gulf of St. Lawrence | 10,932 | 0.36 |

* from data collected on the Twin Otter and AT-11, respectively.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Globicephala* sp. is ~~8,176~~ **10,932** (~~CV=0.65~~) (**CV=0.36**). The minimum population estimate for *Globicephala* sp. is ~~4,968~~ (~~CV=0.65~~) **8,148** (**CV=0.36**).

Current Population Trend

There are insufficient data to determine the population trends for this species.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include those from animals taken in the Newfoundland drive fishery: calving interval 3.3 years; lactation period about 21-22 months; gestation period 12 months; births mainly from June to November; length at birth is 177 cm; mean length at sexual maturity, 490 cm, males; and 356 cm, females; age at sexual maturity is 12 years for males and 6 years for females, and mean adult length is 557 cm for males and 448 cm for females; and maximum age was 40 for males, and 50 for females (Sergeant 1962; Kasuya *et al.* 1988). Analysis of data recently collected from animals taken in the Faroe Islands drive fishery produced higher values for all parameters (Bloch *et al.* 1993; Desportes *et al.* 1993; Martin and Rothery 1993). These differences are likely related, at least in part, to larger sample sizes and newer analytical techniques.

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for *Globicephala* sp. is ~~4,968 (CV=0.65)~~ 8,148 (CV=0.36). The maximum productivity rate is 0.04, the default value for cetaceans. The “recovery” factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be ~~0.45~~ 0.48 because the CV of the average mortality estimate is between ~~0.6-0.8~~ 0.3-0.6; Wade and Angliss 1997), and because this stock is of unknown status. PBR for the western North Atlantic *Globicephala* sp. is ~~45~~ 78.

ANNUAL HUMAN-CAUSED MORTALITY

Total fishery-related mortality and serious injury cannot be estimated separately for the two species of pilot whales in the USA Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury. Total annual estimated average fishery-related mortality or serious injury to this stock during ~~1993-1997 was 40.3 pilot whales (CV=0.71)~~ 1994-1998 was 146 pilot whales (CV=0.22; Table 2).

Fishery Information

USA

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeast coast of the USA. A fishery observer program, which has collected fishery data and information on incidental bycatch of marine mammals, was established in 1977 with the implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA). DWF effort in the Atlantic coast EEZ under MFCMA has been directed primarily towards Atlantic mackerel and squid. An average of 120 different foreign vessels per year (range 102-161) operated within the Atlantic coast EEZ during 1977 through 1982. In 1982, there were 112 different foreign vessels; 18 (16%) were Japanese tuna longline vessels operating along the USA Atlantic coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. The number of foreign vessels operating within the USA Atlantic EEZ each year between 1983 and 1991 averaged 33 and ranged from nine to 67. The number of Japanese longline vessels included among the DWF vessels averaged six and ranged from three to eight between 1983 and 1988. MFCMA observer coverage on DWF vessels was 25-35% during 1977-82, increased to 58%, 86%, 95%, and 98%, respectively, during 1983-86, and 100% observer coverage was maintained from 1987-91. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and, for mackerel, at the end of the 1991 fishing season.

During 1977-1991, observers in this program recorded 436 pilot whale mortalities in foreign-fishing activities (Waring *et al.* 1990; Waring 1995). A total of 391 (90%) were taken in the mackerel fishery, and 41 (9%) occurred during *Loligo* and *Illex* squid-fishing operations. This total includes 48 documented takes by USA vessels involved in joint venture fishing operations in which USA captains transfer their catches to foreign processing vessels. Due to temporal fishing restrictions, the bycatch occurred during winter/spring (December to May) in continental shelf and continental

shelf edge waters (Fairfield *et al.* 1993; Waring 1995); however, the majority of the takes occurred in late spring along the 100 m isobath. Two animals were also caught in both the hake fishery and tuna longline fisheries (Waring *et al.* 1990).

The distribution of long-finned pilot whale, a northern species, overlaps with that of the short-finned pilot whale, a predominantly southern species, between 35E30'N to 38E00'N (Leatherwood *et al.* 1976). Although long-finned pilot whales are most likely taken in the waters north of Delaware Bay, many of the pilot whale takes are not identified to species and bycatch does occur in the overlap area. In this summary, therefore, long-finned pilot whales (*Globicephala melas*) and unidentified pilot whales (*Globicephala* sp.) are considered together.

Data on current incidental takes in USA fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fisheries information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program was initiated in 1989, and since that year several fisheries have been covered by the program. In late 1992 and in 1993, the SEFSC provided observer coverage of pelagic longline vessels fishing off the Grand Banks (Tail of the Banks) and provides observer coverage of vessels fishing south of Cape Hatteras.

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, and pelagic pair trawl fisheries, but no mortalities or serious injuries have documented in the New England Northeast multispecies sink gillnet or mid-Atlantic coastal sink gillnet.

Pelagic Drift Gillnet

The estimated total number of hauls in the pelagic drift gillnet fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls in 1991, 1992, 1993, 1994, 1995, and 1996, and 1998 were 233, 243, 232, 197, 164, and 149, and 113 respectively. In 1996 and 1997, the NMFS issued management regulations which prohibited the operation of this fishery in 1997. Further, in January 1999 the NMFS issued a Final Rule to prohibit the use of driftnets (i.e., permanent closure) in the North Atlantic swordfish fishery (50 CFR Part 630). Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10-12 and 13 vessels have participated in the fishery (Table 2). Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994, 99% in 1995, and 64% in 1996, 1997 (NA), and 99% in 1998. Effort was concentrated along the southern edge of Georges Bank and off Cape Hatteras. Examination of the species composition of the catch and locations of the fishery throughout the year, suggested that the pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total bycatch, from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual bycatch for 1994 and 1995 were estimated from the sum of the observed caught and the product of the average bycatch per haul and the number of unobserved hauls as recorded in self-reported fisheries information. Variances were estimated using bootstrap re-sampling techniques. Between 1989 and 1995 1998, sixty-eight eighty-seven mortalities were observed in the large pelagic drift gillnet fishery. The annual fishery-related mortality (CV in parentheses) was 77 in 1989 (0.24), 132 in 1990 (0.24), 30 in 1991 (0.26), 33 in 1992 (0.16), 31 in 1993 (0.19), 20 in 1994 (0.06), 9.1 in 1995 (0), and 11 in 1996 (.17), 1997 (NA), and 12 in 1998 (0); average annual mortality between 1993-1997 was 17.8 pilot whales (0.09) 1994-1998 was 13 pilot whales (0.04) (Table 2). Table 3 summarizes the number of animals released alive and classified as injured or non-injured. It also includes the ratio of observed to estimated mortalities for this fishery. Because animals released alive may have subsequently died due to injuries received during entanglement, pilot whales that were released were included in the mortality estimates. Pilot whales were taken along the continental shelf edge, northeast of Cape Hatteras in January and February. Takes were recorded at the continental shelf edge east of Cape Charles, Virginia, in June. Pilot whales were taken from Hydrographer Canyon along the Great South Channel to Georges Bank from July-November. Takes occurred at the Oceanographer Canyon continental shelf break and along the continental shelf northeast of Cape Hatteras in October-November.

Pelagic Pair Trawl

Effort in the pelagic pair trawl fishery has increased during the period 1989 to 1993, from zero hauls in 1989 and 1990, to an estimated 171 hauls in 1991, and then to an estimated 536 hauls in 1992, 586 in 1993, 407 in 1994, and 440 in 1995, respectively. This fishery ceased operations in 1996, when NMFS rejected a petition to consider pair trawl gear as an authorized gear type in Atlantic tunas fishery. The fishery operated from August-November in 1991, from June-November in 1992, from June-October in 1993, and from mid-summer to November in 1994 and 1995. Sea sampling began

in October 1992 (Gerritor *et al.* 1994), and 48 sets (9% of the total) were sampled in that season, 102 hauls (17% of the total) were sampled in 1993. In 1994 and 1995, 52% (212) and 54% (238), respectively, of the sets were observed. Twelve vessels have operated in this fishery. The fishery extends from 35°N to 41°N, and from 69°E to 72°E. Approximately 50% of the total effort was within a one degree square at 39°N, 72°W, around Hudson Canyon. Examination of the locations and species composition of the bycatch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge 1996). Five pilot whale (*Globicephala* sp.) mortalities were reported in the self-reported fisheries information in 1993. In 1994 and 1995 observers reported one and twelve mortalities, respectively. The estimated fishery-related mortality to pilot whales in the USA Atlantic attributable to this fishery in 1994 was 2.0 (CV=0.49) and 22 (CV=0.33) in 1995. Since this fishery is no longer exists, it has been excluded from Table 2.

During the 1994 and 1995 experimental fishing seasons, fishing gear experiments were conducted to collect data on environmental parameters, gear behavior, and gear handling practices to evaluate factors affecting catch and bycatch (Goudey 1995, 1996). Results of these studies were inconclusive in identifying factors responsible for marine mammal bycatch.

Pelagic Longline

. The pelagic longline fishery operates in the USA Atlantic (including Caribbean) and Gulf of Mexico EEZ (SEFSC unpublished data). Interactions between the pelagic longline fishery and pilot whales have been reported; however, a vessel may fish in more than one statistical reporting area and it is not possible to separate estimates of fishing effort other than to subtract Gulf of Mexico effort from Atlantic fishing effort, which includes the Caribbean Sea. Total effort, excluding the Gulf of Mexico, for the pelagic longline fishery, based on mandatory self-reported fisheries information, was 11,279 sets in 1991, 9,869 sets in 1992, 9,862 sets in 1993, 9,481 sets in 1994, 10,129 sets in 1995, 9,885 sets in 1996, and 8,023 sets in 1997, and 6,675 sets in 1998 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999a). Since 1992, this fishery has been monitored with about 5% observer coverage, in terms of trips observed, within every statistical reporting area within the EEZ and beyond. Off the USA Atlantic coast, the fishery has been observed from January to March off Cape Hatteras, in May and June in the entire mid-Atlantic, and in July through December in the mid-Atlantic Bight and off Nova Scotia. The 1992-1997, estimated take was based on a revised analysis of the observed incidental take and self-reported incidental take and effort data, and replace previous estimates for the 1992-1993 and 1994-1995 periods (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999). Further, Yeung (1999b), revised the 1992-1997 fishery mortality estimates in Johnson *et al.* (1999) to include seriously injured animals. The 1998 bycatch estimates were from Yeung (1999a). Most of the estimated marine mammal bycatch was from EEZ waters between South Carolina and Cape Cod (Johnson *et al.* 1999). Pilot whales are frequently observed to feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). Between 1990-1997 fifty-eight pilot whales (including two identified as a short-finned pilot whales) were released alive, and one mortality was observed. The condition codes that the observers assigned to the disentangled animals were: alive (41 animals); unknown (10 animals); and dead (5 animals). January-March bycatch was concentrated on the continental shelf edge northeast of Cape Hatteras. Bycatch was recorded in this area during April-June, and takes also occurred north of Hydrographer Canyon off the continental shelf in water over 1,000 fathoms during April-June. During the July-September period, takes occurred on the continental shelf edge east of Cape Charles, Virginia, and on Block Canyon slope in over 1,000 fathoms of water. October-December bycatch occurred along the 20 to 50 fathom contour lines between Barnegatt Bay and Cape Hatteras. The estimated fishery-related mortality to pilot whales in the USA Atlantic (excluding the Gulf of Mexico) attributable to this fishery was: 40 105 in 1992 (CV=1.00), and zero in 1993-1997 15 in 1993 (CV= 1.0), 137 in 1994 (CV=0.44), 258 (includes 58 estimated short-finned pilot whales) in 1995 (CV=0.29), and 0 in 1996-1998; average annual mortality between 1993-1997 was 0 pilot whales 1994 and 1998 was 79 pilot whales (CV=0.24) (Table 2). Seriously injured and released alive animals are not included in the Table 2 mortality estimates. Table 3 summarizes the number of animals released alive and classified as injured or non-injured. It also includes the ratio of observed to estimated mortalities for this fishery.

Bluefin Tuna Purse Seine

The tuna purse seine fishery between Cape Hatteras and Cape Cod is directed at small and medium bluefin and skip jack for the canning industry, while north of Cape Cod purse seine vessels are directed at large medium and giant bluefin tuna (NMFS, 1995). The latter fishery is entirely separate from any other Atlantic tuna purse seine fishery. Spotter aircraft are used to locate fish schools. The official start date is August 15, set by regulation. Individual vessel quotas (IVQs) and a limited access system prevent a derby fishery situation. Catch rates are high with this gear and

consequently, the season usually only lasts a few weeks for large mediums and giants. The 1996 regulations allocated 250 MT (5 IVQs) with a minimum of 90% giants and 10% large mediums. Limited observer data are available for the bluefin tuna purse seine fishery. Out of 45 total trips made in 1996, 43 trips (95.6%) were observed. Forty-four sets were made on the 43 observed trips and all sets were observed. A total of 136 days were covered. Two interactions with pilot whales were observed in 1996. In one interaction, the net was actually pursed around one pilot whale, the rings were released and the animal escaped alive, condition unknown. This set occurred east of the Great South Channel and just north of the Cultivator Shoals region on Georges Bank. In a second interaction, five pilot whales were encircled in a set. The net was opened prior to pursing to let the whales swim free, apparently uninjured. This set occurred on the Cultivator Shoals region on Georges Bank. This fishery was not observed in 1997 and 1998.

North Atlantic Bottom Trawl

Vessels in the North Atlantic bottom trawl fishery, a Category III fishery under the MMPA, were observed in order to meet fishery management needs, rather than marine mammal management needs. An average of 970 (CV= 0.04) vessels (full and part time) participated annually in the fishery during 1989-1993. The fishery is active in New England in all seasons. One mortality was documented in 1990, and one animal was released alive and uninjured in 1993. The estimated fishery-related mortality to pilot whales in the USA Atlantic attributable to this fishery was: ~~0 in 1993-1997~~ **0 in 1994-1998**; average annual mortality between ~~1993-1997 was 0~~ **1994 and 1998 was 0** pilot whales (Table 2). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage. ~~Table 3 summarizes the number of animals released alive and classified as injured or non-injured. It also includes the ratio of observed to estimated mortalities for this fishery.~~

Squid, Mackerel, Butterfish Trawl

The mid-Atlantic mackerel and squid trawl fisheries were combined into the Atlantic mid-water trawl fishery in the revised proposed list of fisheries in 1995. The fishery occurs along the USA mid-Atlantic continental shelf region between New Brunswick, Canada, and Cape Hatteras year around. The mackerel trawl fishery was classified as a Category II fishery since 1990 and the squid fishery was originally classified as a Category II fishery in 1990, but was reclassified as a Category III fishery in 1992. The combined fishery was reclassified as a Category II fishery in 1995. In 1996, mackerel, squid, and butterfish trawl fisheries were combined into the Atlantic squid, mackerel, butterfish trawl fishery, and maintained a Category II classification. Three fishery-related mortality of pilot whales were reported in self-reported fisheries information from the mackerel trawl fishery between 1990-1992. One mortality was observed in the 1996 **and 1998, and both occurred in the** Illex squid fishery. The estimated fishery-related mortality to pilot whales in the USA Atlantic attributable to this fishery was: 45 in 1996, ~~and 0 in 1997, and~~ **85 in 1998**; average annual mortality between ~~1996-1997 was 22.5~~ **1996 and 1998 was 43** pilot whales (~~CV=1.27~~) (**CV=0.61**) (Table 2). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage.

Mid-Atlantic Coastal Gillnet

~~Observer coverage of the USA Atlantic coastal gillnet fishery was initiated by the NEFSC Sea Sampling program in July, 1993; and from July to December 1993, 20 trips were observed. During 1994 and 1995 221 and 382 trips were observed, respectively. This fishery, which extends from North Carolina to New York, is actually a combination of small vessel fisheries that target a variety of fish species, some of which operate right off the beach. The number of vessels in this fishery is unknown, because records which are held by both state and federal agencies have not been centralized and standardized. Observer coverage, expressed as percent of tons of fish landed, was 5% 4%, 3%, and 5% for 1995, 1996, and 1997, and 1998 (Table 2).~~

~~No pilot whales were taken in observed trips during 1993-1997. One pilot whale was observed taken in 1998 (Table 2). Observed effort was concentrated off NJ and scattered between DE and NC from 1 to 50 miles off the beach. All bycatches were documented during January to April. Using the observed takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 7 in 1998 (1.1). Average annual estimated fishery-related mortality attributable to this fishery during 1995-1998 was 2 pilot whales (CV=1.1)~~

CANADA

An unknown number of pilot whales have also been taken in Newfoundland and Labrador, and Bay of Fundy, groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, and Atlantic Canada cod traps (Read 1994). The Atlantic Canadian and Greenland salmon gillnet fishery is seasonal, with the peak from June to September, depending on location. In southern and eastern Newfoundland, and Labrador during 1989, 2,196 nets 91 m long were used. There

are no effort data available for the Greenland fishery; however, the fishery was terminated in 1993 under an agreement between Canada and North Atlantic Salmon Fund (Read 1994).

There were 3,121 cod traps operating in Newfoundland and Labrador during 1979, and about 7,500 in 1980 (Read 1994). This fishery was closed at the end of 1993 due to collapse of Canadian groundfish resources.

Between January 1993 and December 1994, 36 Spanish deep-water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Bank) (Lens 1997). A total of 47 incidental catches were recorded, which included one long-finned pilot whale. The incidental mortality rate for pilot whales was 0.007/set.

In Canada, the fisheries observer program places observers on all foreign fishing vessels, on between 25-40% of large Canadian vessels (greater than 100 ft), and on approximately 5% of small vessels (Hooker *et al.* 1997). Fishery observer effort off the coast of Nova Scotia during 1991-1996 varied on a seasonal and annual basis, reflecting changes in fishing effort (see Figure 3, Hooker *et al.* 1997). During the 1991-96 period, long-finned pilot whales were bycaught (number of animals in parentheses) in bottom trawl (65); midwater trawl (6); and longline (1) gear. Recorded bycatches by year were: 16 in 1991, 21 in 1992, 13 in 1994, 9 in 1995, and 6 in 1996. Pilot whale bycatches occurred in all months except January-March and September (Hooker *et al.* 1997)

Table 2. Summary of the incidental mortality of pilot whales (*Globicephala sp.*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).

| Fishery | Years | Vessels | Data Type ¹ | Observed Serious Injury | Observer Coverage ² | Observed Mortality | Estimated Mortality ⁶ | Estimated CVs | Mean Annual Mortality |
|---|---------------------------|---|------------------------|-------------------------|--|---|--|--|--|
| Pelagic ⁷ Drift Gillnet | 93-97 94-98 | 1994=12 ³ 1995=11 1996=10 1998=13 | Obs. Data Logbook | 0, 0, 0, 0 0 | 42 , .87, .99, .64, NA, .99 | 11 ⁴ , 17, 9, 7, NA, 12 | 31 , 20, 9.1 ⁵ , 11, NA, 12 | 19 , .06, 0, .17, NA, 0 | 17.8 13 ⁷ (0.09) (0.04) |
| Atlantic ⁹ squid, mackerel, butterfish trawl | 96-97 96-98 | NA | Obs. Data Weighouts | 0, 0, 0, 0 0 | .007, .008, .003 | 6, 0, 1 | 45, 0, 85 | 1.27, 0, .65 | 22.5 43 (1.27) (0.61) |
| N. Atl. Otter Trawl | 93-97 94-98 | NA | Obs. Data Weighouts | 0, 0, 0, 0 0 | 0.04 , .004, .011 ⁸ , .002, .002, .001 | 0 , 0, 0, 0, 0, 0 | 0 , 0, 0, 0, 0, 0 | 0 , 0, 0, 0, 0, 0 | 0 0 (0) (0) |
| Pelagic ¹⁰ Longline | 93-97 94-98 | | Obs. Data Logbook | 12, 11, 0, 0, 0 | 06 , .05, .06, .03, .04, .03 | 0 , 0, 0, 0, 0, 0 | 0 , 137, 258, 0, 0, 0 | 0 , 0.44, 0.29, 0, 0, 0 | 0 79 (0) (0.24) |
| Mid- Atlantic Coastal Sink Gillnet | 94-98 | NA | Obs. Data Weighout | 0, 0, 0, 0, 0 | .05, .04, .03, .05 | 0, 0, 0, 1 | 0, 0, 0, 7 | 0, 0, 0, 1.1 | 2 (1.1) |
| Nova Scotia trawl fisheries | 94-96 | NA | Obs. Data | 0, 0, 0, 0, 0 | NA, NA, NA | 13, 9, 6 | 13, 9, 6 | NA, NA, NA | 9 (NA) |
| TOTAL | | | | | | | | | 40.3 146 (0.71) (0.22) |

¹ Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Science Center (NEFSC) Sea Sampling Program. Mandatory logbook (Logbook) data are used to measure total effort for the pelagic drift gillnet and longline fishery, and these data are collected at the Southeast Fisheries Science Center (SEFSC).

² Observer coverage of the mid-Atlantic coastal sink gillnet fishery is measured in tons of fish landed. Observer coverage for the pelagic drift gillnet, pair trawl and longline fishery are in terms of sets. The trawl fisheries are measured in trips.

³ 1994, 1995 and 1996 shown, other years not available on an annual basis.

- ⁴ For 1991-1993, pooled bycatch rates were used to estimate bycatch in months that had fishing effort but did not have observer coverage. This method is described in Northridge (1996). In 1994 and 1995, observer coverage increased substantially, and bycatch rates were not pooled for this period.
- ⁵ One vessel was not observed and recorded 1 set in a 10 day trip in the SEFSC mandatory logbook. If you assume the vessel fished 1.4 sets per day as estimated from the 1995 SS data, the point estimate may increase by 0.84 animals. However, the SEFSC mandatory logbook data was taken at face value, and therefore it was assumed that 1 set was fished within this trip, and the point estimate would then increase by 0.06 animals.
- ⁶ Annual mortality estimates do not include any animals seriously injured and released alive animals.
- ⁷ The fishery did not operate in 1997; the average annual mortality is based on the number of years (4; 1993-1996, 1994, 1995, 1996, and 1998) that the fishery operated.
- ⁸ Observer coverage for the Atlantic bottom trawl fishery in 1995 is based on only January to May data.
- ⁹ In 1997 and 1998 the observed pilot whales were taken from the *Illex* squid otter trawl subfishery.
- ¹⁰ Mortality estimates were taken from Table 12 in Johnson *et al.* (1999); Yeung (1999a,b) and exclude the Gulf of Mexico.

Table 3. Summary of pilot whales (*Globicephala* sp.) released alive, by commercial fishery, years sampled (Years), ratio of observed mortalities recorded by on-board observers to the estimated mortality (Ratio), the number of observed animals released alive and injured (Injured), and the number of observed animals released alive and uninjured (Uninjured):

| Fishery | Years | Ratio | Injured ³ | Uninjured ⁴ |
|-----------------------------|----------------|--|--|---|
| Pelagic Drift Gillnet | 93-97 94-98 | 11/31, 17/20, 9/9, 1, 7/11, NA, 12/12 | 1 ⁺ ; 0, 0, 0, NA, 0 | 0 |
| Pelagic Long Line | 93-97 94-98 | 0, 0, 0, 0, 0, 0, 0 | NA, 5 ² , 4 ² , 0, 1 ² , 1 | 16 ⁺ , 9 ² , 10 ² , 0, 0, 0 |
| North Atlantic Bottom Trawl | 93-97 94-98 | 0, 0, 0, 0, 0, 0, 0 | 0, 0, 0, 0, 0, 0, 0 | 0, 1, 0, 0, 0, 0, 0 |

⁺ Released alive with condition unknown.

² See Appendix 1.

³ Injured and released alive animals are not included in the Table 2 mortality estimates.

⁴ Data from Table 6 (Johnson *et al.* 1999 and Table 6 (Yeung 1999). Information on status of released animals was not reported.

Other Mortality

Pilot whales have a propensity to mass strand throughout their range, but the role of human activity in these events is unknown. Between two and 120 pilot whales have stranded annually either individually or in groups in NMFS Northeast Region (Anon. 1993b) since 1980. From 1992-1997, 65 71 long-finned pilot whale stranded between South Carolina and Maine, including 22 animals that mass stranded in 1992 along the Massachusetts coast (NMFS unpublished data).

In eastern Canada, six dead strandings were reported on Sable Island, Nova Scotia from 1990-1996; and fourteen strandings along Nova Scotia from 1991-1996 (Hooker *et al.* 1997; Lucas and Hooker 1997).

A potential human-caused source of mortality is from polychlorinated biphenyls (PCBs) and DDT, moderate levels of which have been found in pilot whale blubber (Taruski 1975; Muir *et al.* 1988). The effect of the observed levels of such contaminants is unknown.

STATUS OF STOCK

The status of long-finned pilot whales relative to OSP in USA Atlantic EEZ is unknown, but stock abundance may have been affected by reduction in foreign fishing, curtailment of the Newfoundland drive fishery for pilot whales in 1971, and increased abundance of herring, mackerel, and squid stocks. There are insufficient data to determine the

population trends for this species. The species is not listed under the Endangered Species Act. The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This is ~~not~~ a strategic stock because the ~~1993-1997~~ **1994-1998** estimated average annual fishery-related mortality, including Nova Scotia bycatches to pilot whales, *Globicephala* sp., ~~is less than~~ **exceeds** PBR.

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